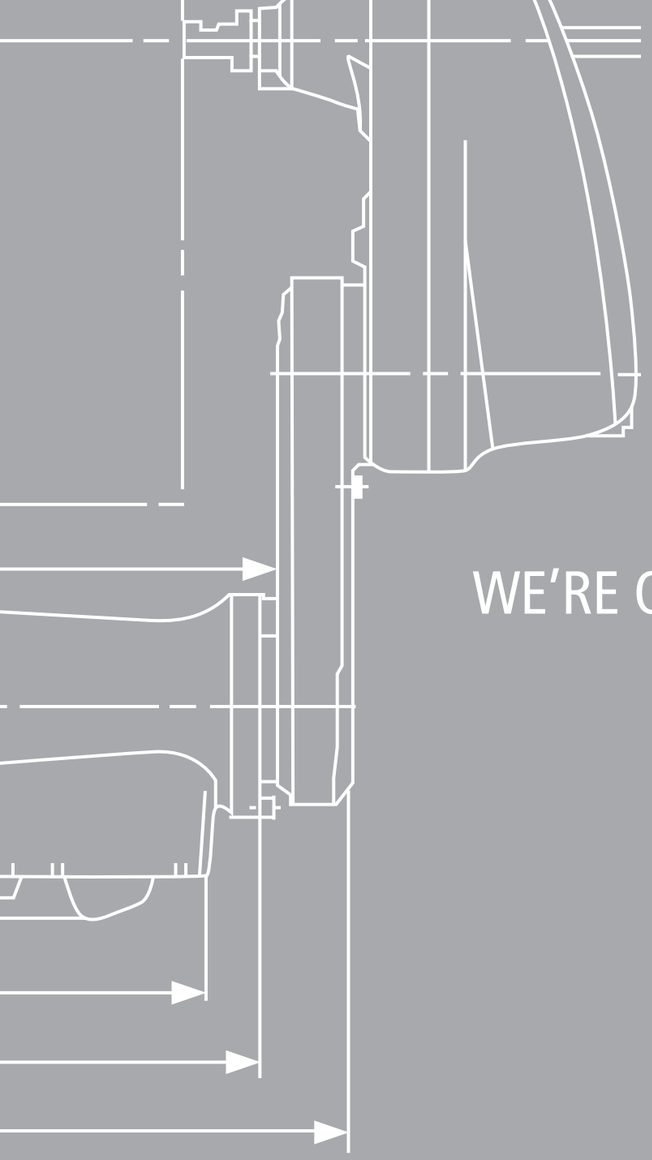


WE'RE ONLY SATISFIED

WHEN YOU ARE

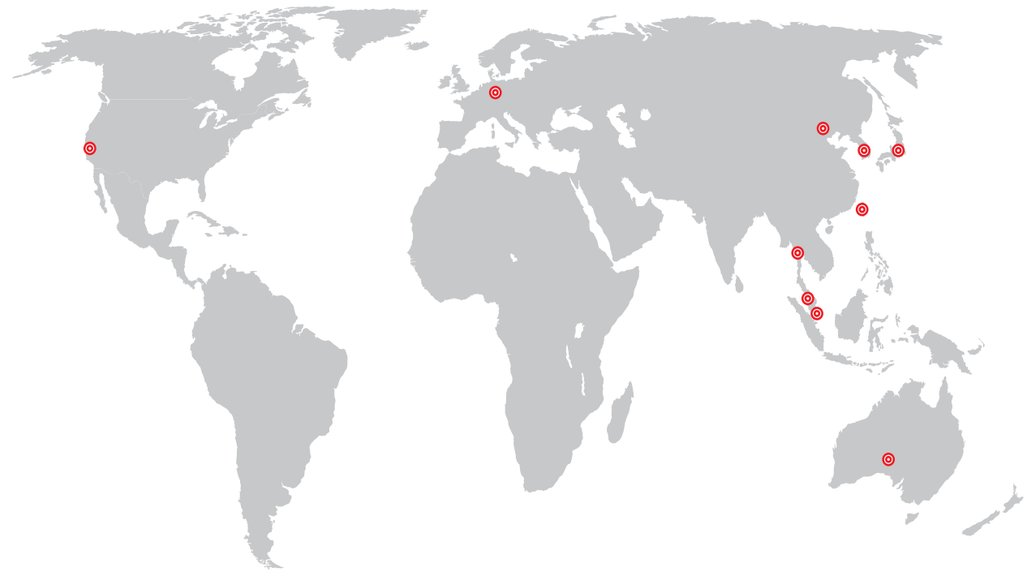
Cutting edge technology, class leading products and groundbreaking systems are only part of what you can expect when you choose DENSO Robotics.

Our international customer support facility also leads the way in terms of service and delivery. We provide a highly personalised, professional and friendly resource to help with all of your questions and queries. Whether you need one-to-one assistance over the telephone, or a physical site visit, our teams of highly qualified engineers, technicians and partner system integrators are ready and waiting all over the globe.

In the world of robotics, we never forget that the human touch is the most important one of all.

OUR WORLDWIDE NETWORK

Our international network of offices provides comprehensive service and support all over the world.



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TECHNOLOGY WITH TRADITION

The new VS-087

When you choose a robotic solution from DENSO you can rest assured that you are investing in a product of the highest calibre. Our commitment to quality and customer satisfaction is, quite simply, second-to-none.

DENSO Robotics is proud to be a part of the DENSO Corporation, which is recognised as one of the 500 largest companies worldwide (Fortune Global 500) and is also one of the two largest automotive parts manufacturers in the world.

It is this strength in depth that allows DENSO Robotics to be such a pioneering force. In fact, our vision and aptitude have seen the company become the recognised worldwide leader in small robotic design and manufacturing.

When industrial robots first appeared in the early 1960s, DENSO began to develop and apply the emerging technologies to its own production processes, allowing the company to constantly improve and advance the hardware and software.

And now, today, as the established market leader in the small assembly industrial robot segment, DENSO Robotics continues to set the benchmark in reliability, flexibility and functionality. With more than **60 000 DENSO robots installed across the globe – 16 000 of which are employed in its own manufacturing facilities** – no other company has more knowledge or expertise.

DENSO Robotics is the automatic choice when it comes to industrial robot arms.

THE ULTIMATE ANSWER

Whatever challenge you face, DENSO Robotics has the answer. Our product range includes four-axis (SCARAs) and five and six-axis robots. All of which are defined by their outstanding speed, precision and build quality.

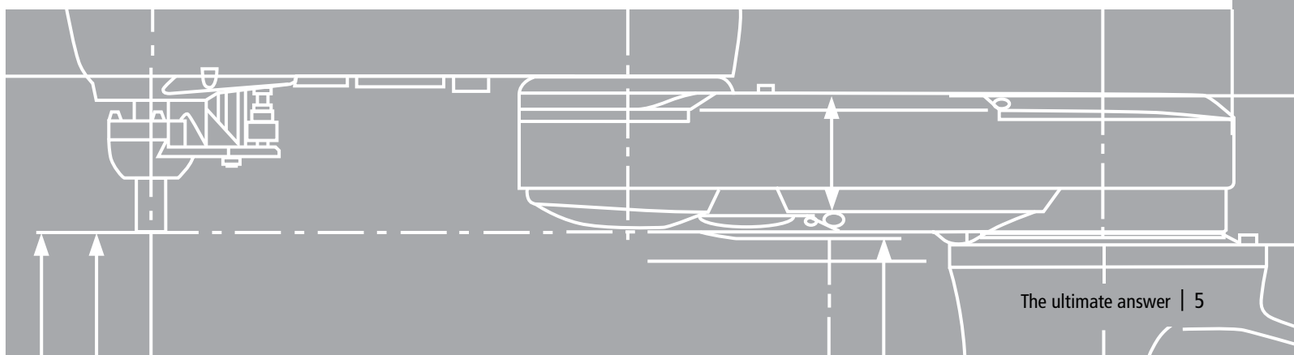
For the pinnacle in functionality, our robots can manage payloads of up to 20 kg and each and every model is designed to perform to the highest possible standards. Compact, light and requiring only minimal periodic maintenance, our entire robot range also comes with a class leading two-year guarantee.

To add to the cost efficiency and ease of use of our robots, there is only one controller type for all robot models, you only need one controller for each robot. All that is necessary is to exchange motor drivers, which can be done quickly and simply. DENSO robots have also been designed to operate in virtually any environment including dusty, wet or clinical surroundings. The protection ratings of our robots are classed as follows:

- Standard
- Dust & splash proof (IP65)
- Protected (IP67)
- Clean room classes 10 and 100
- H_2O_2 resistant (Hydrogen Peroxide; commonly used for sterilization purposes in the pharmaceutical and medical industries)
- UL specifications (for the USA and Canada)

As further testament to DENSO Robotics credentials and reputation in the robotic arm marketplace, important competitors rely on us to supply them with unbranded hardware so they can increase and complete their own product ranges.

There is no better answer than DENSO Robotics.



INCREASING YOUR PRODUCTIVITY

INCREASING YOUR SUCCESS

As a business operating in today's global economy, it is imperative to be as lean and proficient as possible without compromising anything in terms of quality and service.

Consumers demand the highest class of products at the most competitive prices. And shareholders expect a positive return on their investments.

So how do you establish an advantage while still maintaining integrity?

How do you ensure that your systems are delivering the most effective TCO?

That's where DENSO Robotics can help.

We can reduce your production costs and increase your speed to market in the following ways

- The unparalleled speed and precision of our robots save you time. Processes are completed faster and more accurately
- Our robots are hugely reliable and durable. There is minimal down time. And that means your production procedures operate at maximum efficiency
- The highly compact and lightweight design of our robots saves space. There is no unnecessary bulk or equipment. Your manufacturing area is utilised to its full capacity
- Our robots require the minimum amount of servicing and upkeep. Which means they constantly perform without the time and expenditure incurred by regular maintenance
- Because of their low energy consumption, DENSO robots keep power costs to a minimum while also helping the environment

Putting the environment first

The environment is a crucial consideration during the production of DENSO robots and we are completely dedicated to reducing the use of hazardous substances.

Our awareness and commitment mean that DENSO robots are an environmentally friendly, ultra efficient and highly profitable investment. Ultimately, our products and systems can help realise the full potential of your business in an eco-friendly manner.

FLEXIBLE. FAST. EFFECTIVE.

From general manufacturing through to the pharmaceutical sector, a huge range of industries can benefit from the ways DENSO robots streamline and improve processes and procedures.

The versatility and advanced functionality of our products allow them to be programmed for virtually any situation where a robotic arm is applicable. Whether the requirement is for straightforward "pick and place" or incredibly complex tasks and routines, such as the fully automated preparation of a medical injection, DENSO robots are at the forefront of today's industrial applications.

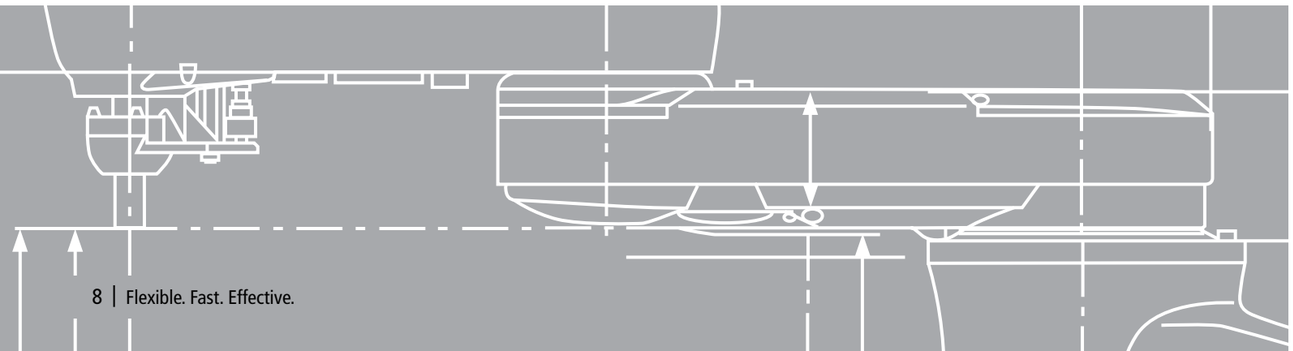
Here is a brief overview of where and how DENSO Robotics can add value and efficiency to your business.

Industries:

- Appliances
- Automotive
- Chemicals
- Consumer products
- Electronics
- Food
- General manufacturing
- Greenhouse
- Machine tools
- Medical devices
- Pharmaceuticals
- Semiconductor
- Plastics
- And many others

Applications:

- Pick & place
- Assembly
- Packaging
- Dispensing
- Palletizing
- Inspection
- Material removal
- Material handling
- Electrostatic welding
- Customised projects



INTELLIGENT INTERACTION

DENSO robots have been conceived and produced so that programming them is as convenient and user-friendly as possible. We have developed a range of tools that allow you to interact with our robots in a manner you find the most comfortable and familiar.

For ease and simplicity, all DENSO robot controllers have a standard Ethernet connection for attaching to another device such as a PLC or industrial PC.

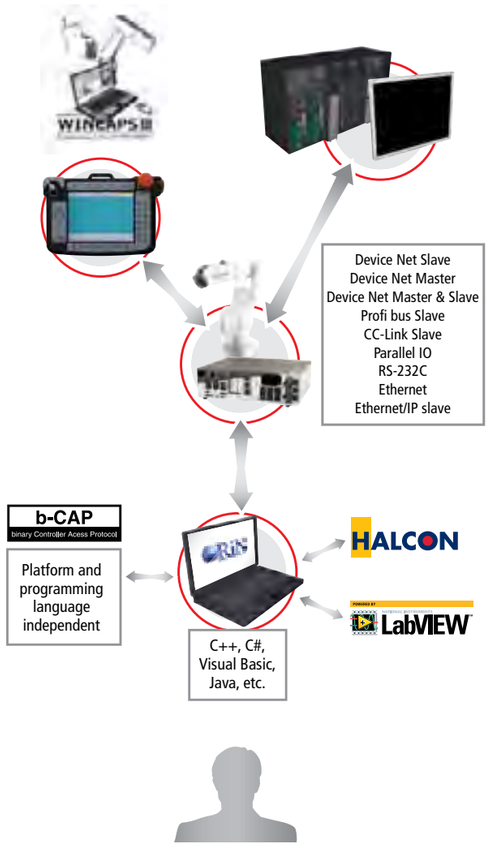
The adaptable choice of ways that you can input instructions into DENSO robots includes the following:

Teaching pendant:

- DENSO touch screen teaching pendant

PC-based solutions:

- **WINCAPS III**
  DENSO's proprietary off-line programming, monitoring and simulation software
- **ORiN2**
  Innovative middleware that enables the use of existing high level languages, including C++, C#, Visual Basic and Java, etc. to program DENSO robots, therefore eliminating the requirement to learn any new robot programming language
- **NI LabVIEW™ Software**
  The graphical programming language from National Instruments™ has a dedicated toolkit created by the Italian company ImagingLab designed specifically for easily programming DENSO robots
- **b-CAP**
  binary Controller Access Protocol is an option available within ORiN2. The system is based on TCP/IP or UDP and connects to DENSO robots and peripheral devices via a PC, PLC or any other appropriate device that includes an Ethernet TCP/IP connection
- **HALCON extension library**
  Dedicated extension package to enable HALCON from MVTec and DENSO users to conveniently program and control DENSO robots and their vision applications through the same simple graphical interface



NI LabVIEW™ Software is trademark of National Instruments™ HALCON and MVTec are registered trademarks

A FULL LINE-UP OF SMALL INDUSTRIAL ROBOTS

The VPG2 Series includes a robot model for pharmaceutical and medical applications (VP-G2-S1)

NEW

VP | VPG2 | NEW VS | VS | VM | HS | HM | XR

6-AXIS ROBOTS

Ideal for:

- Assembly
- Inspection
- Matching
- Material handling
- Machine tending
- Packaging
- Palletizing
- Electrostatic welding
- Bespoke applications

Industries:

Our robots are employable in a wide variety of industries including pharmaceutical, medical and food.

Available in Protection Classes:

- Standard
- Dust & Splash Proof (IP65)
- Protected (IP67)
- Clean Room Class 10 & 100
- Hydrogen Peroxide-resitant (H_2O_2) for aseptic environments
- UL Specifications (for the USA and Canada)

Main features:

- Payloads up to 10 kg
- Arm reach up to 1300 mm
- Max. Comp. Speed up to 11 000 mm/s
- Mounting in floor, ceiling and wall

4-AXIS ROBOTS

Ideal for:

- Pick & place
- Assembly
- Packaging
- Dispensing
- Inspection
- Material removal
- Material handling
- Bespoke applications

Industries:

Our robots are employable in a wide variety of industries including pharmaceutical, medical and food.

Available in Protection Classes:

- Standard
- Dust & Splash Proof (IP65)
- Clean Room Class 10
- UL Specifications (for the USA and Canada)

Main features:

- Payloads up to 20 kg
- Arm reach up to 1000 mm
- Max. Comp. Speed up to 11 500 mm/s
- Mounting in floor and ceiling

DENSO 6-AXIS ROBOTS

The DENSO range of 6-axis robots includes the VP Series, the VS Series, the VM series and additionally DENSO's new VS models with both long and short arm lengths.

These robots provide greater flexibility and improved performance over their 4-axis counterparts. Because of their increased scale of movement, they are suited to handle a far wider range of applications without compromising either speed or precision.

DENSO 6-axis robots are the ultimate solution for the following:

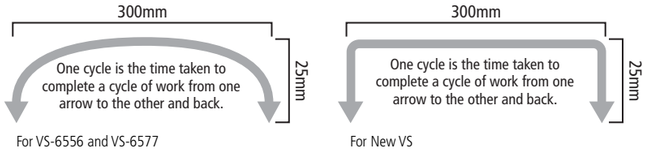
Applications

- Assembly
- Inspection
- Matching
- Material handling
- Material tending
- Packaging
- Palletizing
- Electrostatic welding
- Bespoke applications

DENSO 6-axis robots deliver the following industry leading specifications:

Main Features

- Cycle times ranging from 0.99 s to 0.33 s
- Constant precision of between ±0.07 mm and ±0.02 mm
- Maximum composite speed from 3900 mm/s up to 11 000 mm/s
- Arm lengths between 430 mm and 1298 mm
- Payloads up to 10 kg
- All models include internal wiring and air piping for maximum efficiency in restricted spaces


300mm
One cycle is the time taken to complete a cycle of work from one arrow to the other and back.
25mm
For VS-6556 and VS-6577
300mm
One cycle is the time taken to complete a cycle of work from one arrow to the other and back.
25mm
For New VS

Options

- Standard
- Dust & splash proof (IP65)
- Protected (IP67)
- Clean room class 10 / 100
- Hydrogen Peroxide-resitant (H_2O_2) for aseptic environments
- UL specifications (for the USA and Canada)

product design award 2011

The new VS-087

THE NEW VS SERIES

NEW

DENSO proudly presents its new VS Series. These new 6-axis robots are characterized as being extremely:

- FAST (up to 11 000 mm/s)
- PRECISE (±0.03 mm and ±0.02 mm)
- FLEXIBLE (install them on floors, ceilings or walls)

In addition:

- Their extremely slim and compact design allows you to save on installation space
- You also have the possibility to place the motor and encoder cable underneath the robot base
- They offer you payloads up to 7 kg, delivering you the best performance possible

Connectivity

The optional "Communication Interface" allows users to connect Gigabit Ethernet devices and Servo Grippers easily and directly to the robot flange, thanks to an innovative communication internal wiring. This gives users the advantage of avoiding the risk of cables and connections tangling up within their surroundings.

Resistant

You can employ these robots in extremely wet conditions thanks to their optional protection class IP67 (which resists even high pressure washing and cutting chips).

Have a look at the new VS Series and convince yourself why we're pioneers in robotics. It is worth it!

product design award 2011

The new VS-087

THE NEW VS SERIES

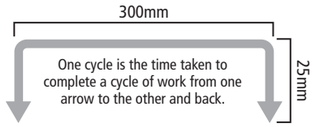
Fast motion for improved productivity

Pick & place / Maximum composite speed:

	VS-050	VS-068
Pick & place time [s] at 1 kg (measurement)	0.37	0.33
Maximum composite speed [mm/s]	9000	11 000

Pick & Place time

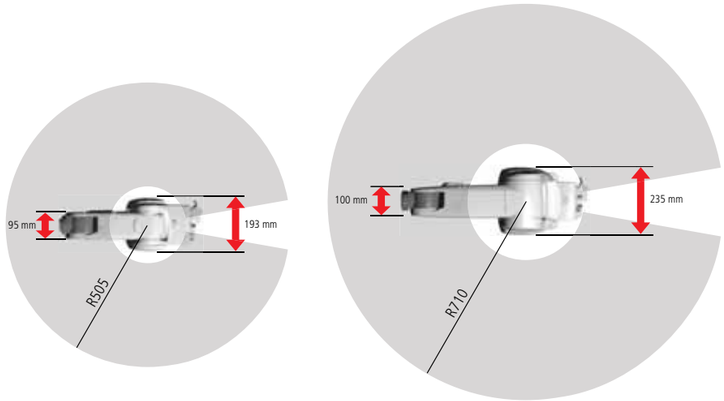
Time required for a robot to lift an object to a height of 2.5 cm and move back and forth between two locations 30 cm apart.



VS-050
Maximum motion area: 505 mm
Maximum payload: 4 kg

Can be integrated into compact equipment

Arm width/Wrist width/Motion area

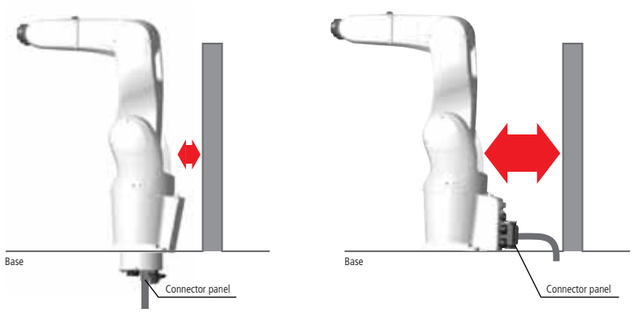


VS-050 VS-068

VS-060
Maximum motion area: 605 mm
Maximum payload: 4 kg

VS-068
Maximum motion area: 710 mm
Maximum payload: 7 kg

Efficient use of dead space



VS-087
Maximum motion area: 905 mm
Maximum payload: 7 kg

Improved usability and maintainability

Embedded internally up to end-of-arm flange, wires are prevented from becoming entangled and broken.

New VS Series options

Connector panel

Rear connector panel

Bottom connector panel

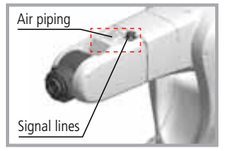
Choose from two mounting orientations when connecting cables (robot-to-controller cable, etc.) to the robot for increased flexibility accommodating user's robot installation conditions.

Flange

Communicaton interface flange-A

Flange has connectors for electrical signals and Ethernet, allowing wiring to be embedded in the robot unit. Use them to connect a motorized hand, camera, etc.

Signal lines & Air piping



Signal lines and air pipe solenoid valves are embedded in the top area of the second arm. Three varieties are available for VS-068 / 087 and one for VS-050 / 060.

Paint / Surface finish

DENSO standard colors

Unpainted

Where Protected type (IP67) is selected, the unit is left as unpainted aluminum. Protected type (IP67) plus standard coloring is available as (optional) extra specification. Contact us for further information.

External battery extention unit

Encoder backup battery installed outside the robot facilitates replacement of batteries and improves maintainability.

Brake release unit

A Switch that allows you to release the brake of each axis (wiring of this switch is directly connected to the brake release signal of each axis).

Air purge unit

The Protected type (IP67) maintains an IP67 protection level by air pressure produced inside the robot.

Second arm cover R (with tapped holes)

This cover has tapped holes to secure wires for the robot's second arm.

Category	Part name	VS-050 / 060		VS-068 / 087	
		Standard type (IP40)	Protected type (IP67)	Standard type (IP40)	Protected type (IP67)
Connector Panel	Rear connector panel	✔	✔	✔	✔
	Bottom connector panel	-	-	✔	✔
Flange	Standard flange	✔	✔	✔	✔
	Communication interface flange-A	✔	-	✔	-
Signal lines	2 x solenoid valves (2 position, double solenoid)	✔	✔	-	-
	3 x solenoid valves (2 position, double solenoid)	-	-	✔	✔
	3 x solenoid valves (3 position, exhaust center solenoid)	-	-	✔	✔
	3 x solenoid valves (3 position, closed center solenoid)	-	-	✔	✔
Paint/Surface finish	DENSO standard colors	✔	*1	✔	*1
	Unpainted	-	✔	-	✔
External battery extention unit		✔	✔	✔	✔
Brake release unit		✔	✔	✔	✔
Air purge unit		-	✔	-	✔
Second arm cover R (with tapped holes)		✔	-	✔	-

*1. Extra specification (optional). Contact us for further information.

DENSO 4-AXIS ROBOTS

The DENSO range of 4-axis robots includes the HS Series and the HM Series.

Also known as SCARA (Selective Compliance Assembly Robot Arm), they are the perfect option for a wide range of purposes.

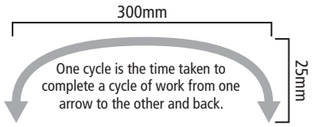
If you are looking for a high speed, exceptionally precise arm that can handle payloads up to 20 kg then DENSO SCARA robots are the ideal choice for the following:

Applications

- Pick & Place
- Inspection
- Assembly
- Material removal
- Packaging
- Material handling
- Dispensing
- Bespoke applications

Main Features

- Cycle times ranging from 0.35 s to 0.29 s
- Constant precision of between ±0.025 mm and ±0.015 mm
- Maximum composite speed from 6300 mm/s up to 11 500 mm/s
- Arm lengths between 350 mm and 1000 mm
- Payloads up to 20 kg
- All models include internal wiring and air piping for maximum efficiency in restricted spaces



Because of their extremely compact dimensions, light weight and flexibility to be mounted on both floor and ceiling, DENSO SCARA robots are perfectly suited for environments where space is at a premium.

The circular work envelope of the robots is controlled by movement through 4-axis and, while rigid, the units have increased horizontal flexibility, enhancing the scope of their effectiveness.

To allow operation in virtually any industrial condition, DENSO 4-axis robots are available in the following protection classes:

Options

- Standard
- Dust & splash proof (IP65)
- Clean room class 10
- UL specifications (for the USA and Canada)

KEY FEATURES

HS SERIES 350 - 550 MM

The DENSO HS Series of robots is ideal for circumstances where size constraints are a key consideration.

- Exceptional precision: from ±0.02 mm up to ±0.015 mm
- Low cycle times: 0.35 s
- Maximum composite speed: from 6300 mm/s up to 7200 mm/s
- Payloads: up to 5 kg
- Arm reach: from 350 mm up to 550 mm
- Mounting options: floor and ceiling
- Operation in dusty and wet environments (optional specification to IP65 standard)
- Operation in clean rooms (optional specification to CC10 standard)
- ANSI and CE compliance: allows global deployment. Choose a Safety board / Safety box controller
- UL specifications (for the USA and Canada)

HS-4535*G

HS-4545*G

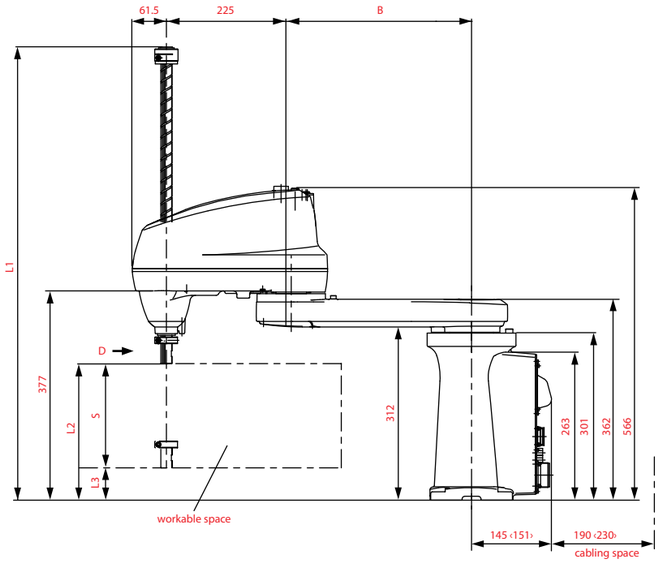
HS-4555*G

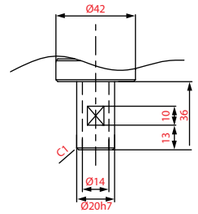
		Unit	HS-4535*G	HS-4545*G	HS-4555*G
Number of axis			4	4	4
Mounting configuration			Floor	Floor, Ceiling	Floor, Ceiling
Arm configuration	Protection degree		IP65	IP65	IP65
	Cleanroom (1)		Class 10 (ISO 1)	Class 10 (ISO 1)	Class 10 (ISO 1)
UL specification (1)			✔	✔	✔
Maximum arm reach		mm	350	450	550
Payload		kg	5	5	5
Motion range	J1	deg	±155	±155 (Ceiling ±152)	±155
	J2		±145	±145 (Ceiling ±141)	±145
	Z	mm	200, 320	150, 200, 320 (3)	150, 200, 320 (3)
	T	deg	±360	±360	±360
Maximum composite speed	At the center of the hand mounting flange	mm/s	7200	6300	7100
	Z		2000	2000	2000
	T	deg/s	2400	2400	2400
Cycle time		s	0.35 (with 2 kg weight)	0.35 (with 2 kg weight)	0.35 (with 2 kg weight)
Position repeatability (2)	J1+J2	mm	±0.015	±0.02	±0.02
	Z	mm	±0.01	±0.01	±0.01
	T	deg	±0.05	±0.05	±0.05
Allowable inertia		kgm^2	0.1 (with 5 kg)	0.1 (with 5 kg)	0.1 (with 5 kg)
Weight		kg	25	25	25
User signal line			19 (for proximity sensor signals, etc.)		
Pneumatic pipe			4 systems (φ4x2, φ6x2)		
Brakes			Brakes for Z axis (3rd axis) and T axis (4th axis)		

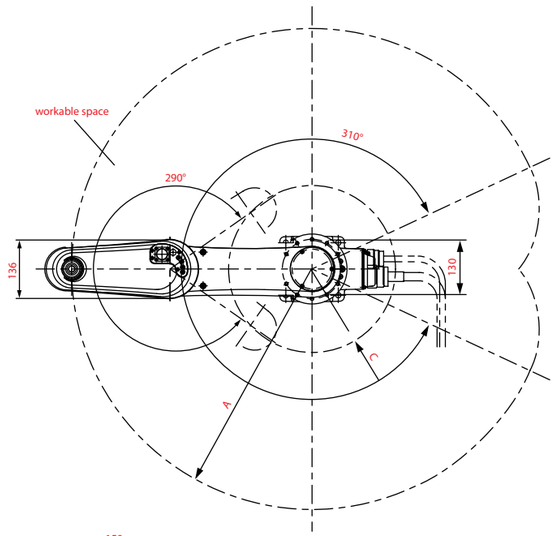
1. Only for floor-mounted. 2. Position repeatability is the value at constant ambient temperature. 3. Z-axis stroke 150 mm is available only for HSS (Ceiling-mounted). For details, please contact our sales.

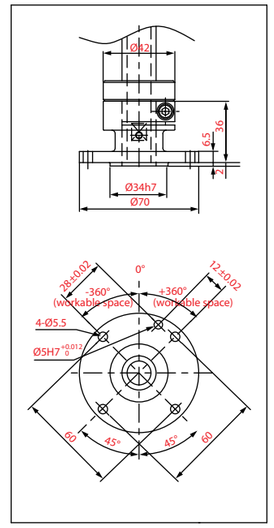
S (mm)	Type	L1	L2	L3
*=2:200	Standard	697	246	46
	Dust- & splash-proof	790	206	6
	Cleanroom	798		
*=3:320	Standard	817	246	-74*1
	Dust- & splash-proof	910	206	-114*1
	Cleanroom	918		

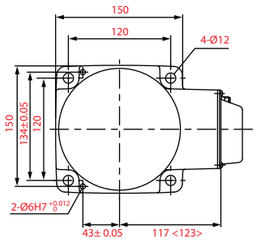
*1 If the Z-axis stroke is 320 mm, the Z axis in the lowermost position may reach below the base mounting face.











Unit: mm

Model	A	B	C
HS-4535*G	350	125	143
HS-4545*G	450	225	136
HS-4555*G	550	325	191

KEY FEATURES

HM SERIES 600 - 1000 MM

The DENSO HM Series of robots offers a higher payload than the HS model range and also features a longer arm reach.

- Exceptional precision: from ±0.025 mm up to ±0.02 mm
- Low cycle times: 0.31 s and 0.29 s
- Maximum composite speed: from 8800 mm/s up to 11 500 mm/s
- Payloads: up to 20 kg
- Arm reach: from 600 mm up to 1000 mm
- Mounting options: floor and ceiling
- Operation in dusty and wet environments (optional specification to IP65 standard)
- ANSI and CE compliance: allows global deployment. Choose a Safety board / Safety box controller
- UL specifications (for the USA and Canada)

HM-4A60*G

HM-4A70*G

HM-4A85*G

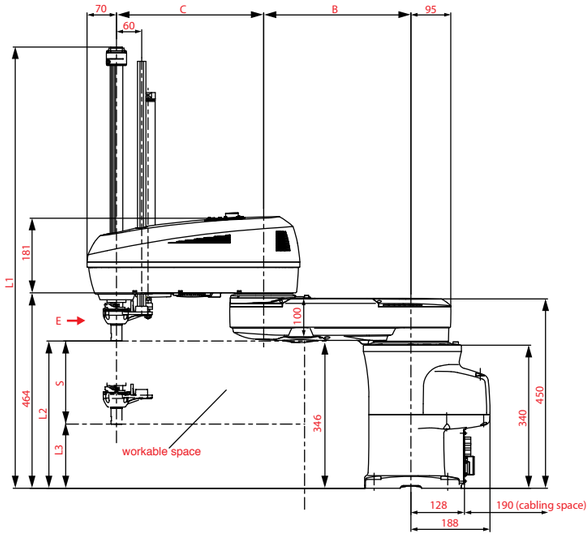
HM-4AA0*G

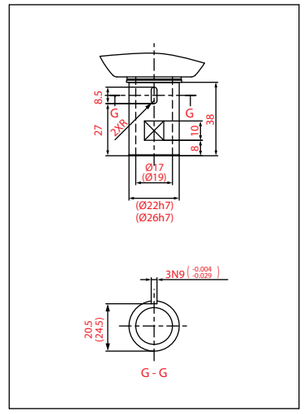
		Unit	HM-4060*G	HM-4A60*G	HM-4070*G	HM-4A70*G	HM-4085*G	HM-4A85*G	HM-40A0*G	HM-4AA0*G
Number of axis			4	4	4	4	4	4	4	4
Mounting configuration			Floor	Floor	Floor, Ceiling	Floor, Ceiling	Floor, Ceiling	Floor, Ceiling	Floor	Floor
Arm configuration	Protection degree		IP65	IP65	IP65	IP65	IP65	IP65	IP65	IP65
	Cleanroom		-	-	-	-	-	-	-	-
UL specification (1)			✔	✔	✔	✔	✔	✔	✔	✔
Maximum arm reach		mm	600	600	700	700	850	850	1000	1000
Payload		kg	10	20	10	20	10	20	10	20
Motion range	J1	deg	±165	±165	±165	±165	±165	±165	±165	±165
	J2	deg	±143 (Dust & Splash-proof type ±140)		±147 (Ceiling ±145, Dust & Splash-proof type ±146, Ceiling Dust & Splash-proof type ±142)		±147 (Ceiling ±142)		±147	
	Z	mm	100, 150, 200, 300 (3)	100, 150, 200, 300 (3)	100, 150, 200, 300 (3)	100, 150, 200, 300 (3)	100, 150, 200, 300 (3)	100, 150, 200, 300 (3)	100, 150, 200, 300 (3)	100, 150, 200, 300 (3)
	T	deg	±360	±360	±360	±360	±360	±360	±360	±360
Maximum composite speed	At the center of the hand mounting flange	mm/s	8780	8780	9570	9570	11 450	11 450	11 390	11 390
	Z	mm/s	2760	2760	2760	2760	2760	2760	2760	2760
	T	deg/s	2220	1540	2220	1540	2220	1540	2220	1540
Cycle time		s	0.29 (with 2 kg weight)	0.29 (with 2 kg weight)	0.29 (with 2 kg weight)	0.29 (with 2 kg weight)	0.31(with 2 kg weight)	0.31(with 2 kg weight)	0.31(with 2 kg weight)	0.31(with 2 kg weight)
Position repeatability (2)	J1+J2	mm	±0.02	±0.02	±0.02	±0.02	±0.025	±0.025	±0.025	±0.025
	Z	mm	±0.01	±0.01	±0.01	±0.01	±0.01	±0.01	±0.01	±0.01
	T	deg	±0.05	±0.05	±0.05	±0.05	±0.05	±0.05	±0.05	±0.05
Allowable inertia		kgm^2	0.25 (with 10 kg)	0.45 (with 20 kg)	0.25 (with 10 kg)	0.45 (with 20 kg)	0.25 (with 10 kg)	0.45 (with 20 kg)	0.25 (with 10 kg)	0.45 (with 20 kg)
Weight		kg	Standard: 53, Ceiling: 54, Dust & Splash-proof: 56							
User signal line			24 (for proximity sensor signals, etc.)							
Pneumatic pipe			4 systems (φ6)							
Brakes			Brake for Z axis (3rd axis)							

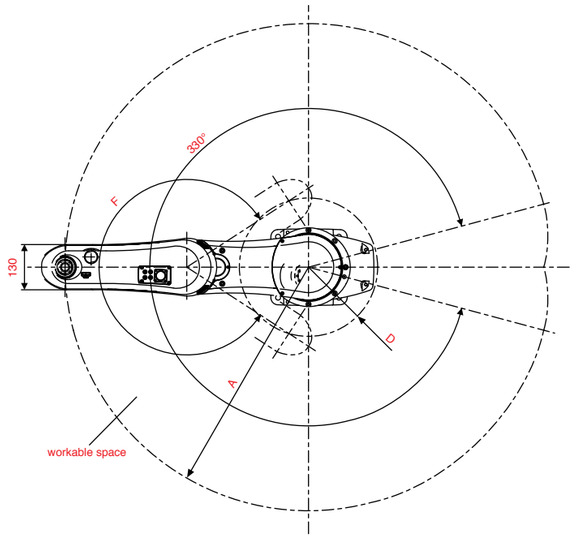
1. Only for floor-mounted. 2. Position repeatability is the value at constant ambient temperature. 3. Z-axis stroke 100 mm and 150 mm are available only for HM (floor-mounted). For details, please contact our sales.

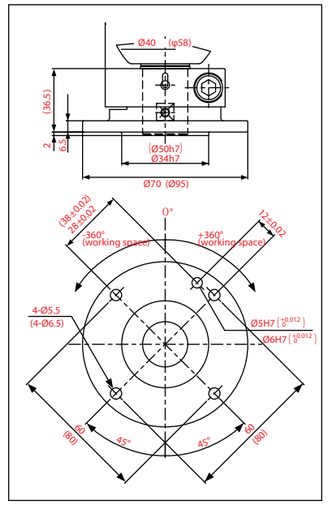
Type	A	B	C	D	F
HM-4060*G, HM-4A60*G	600	250	350	213	286°
HM-4070*G, HM-4A70*G	700	350	350	199	294°
HM-4085*G, HM-4A85*G	850	350	500	281	294°
HM-40A0*G, HM-4AA0*G	1000	500	500	284	294°

Note 1: Values denote dimensions for the 10 kg payload type (HM-40**G), and values enclosed in () denote dimensions for the 20 kg payload type (HM-4A**G).

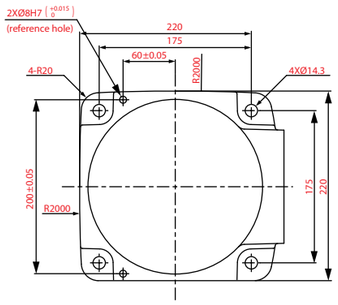








Unit: mm



S (z axis stroke)	L1		L2	L3
	10 kg	20 kg		
100	755	749	350	250
150	805	799	350	200
200	855	849	350	150
300	955	949	350	50
400 (Note 2)	1055	1049	350	-50

Note 2: In the case of the Z axis 400 mm stroke type, the lowermost end of the Z axis may reach a lower position than the base mounting face.

KEY FEATURES

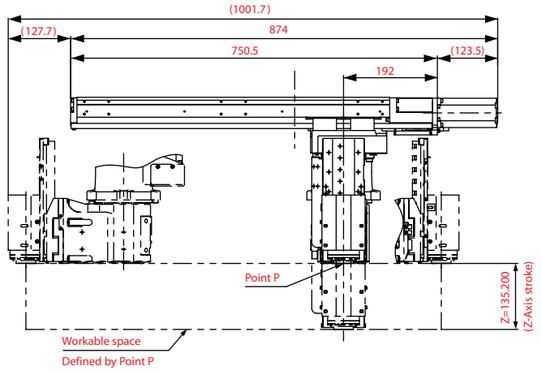
XR SERIES

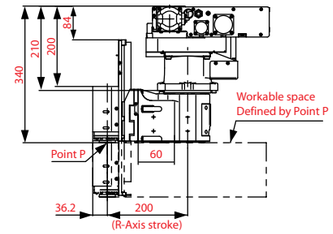
The DENSO XR Series of robots can be mounted on the ceiling.

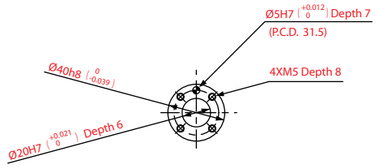
- Operation in restricted spaces
- Faster than Cartesian robots with combined movement of coordinated slide (X-axis) and swivel motions (R-axis)
- Easily fits into low-height restrictions
- Corresponds with narrow frontage facility with its compact size
- Combined compactness and wide range motion area by original "X-R" structure

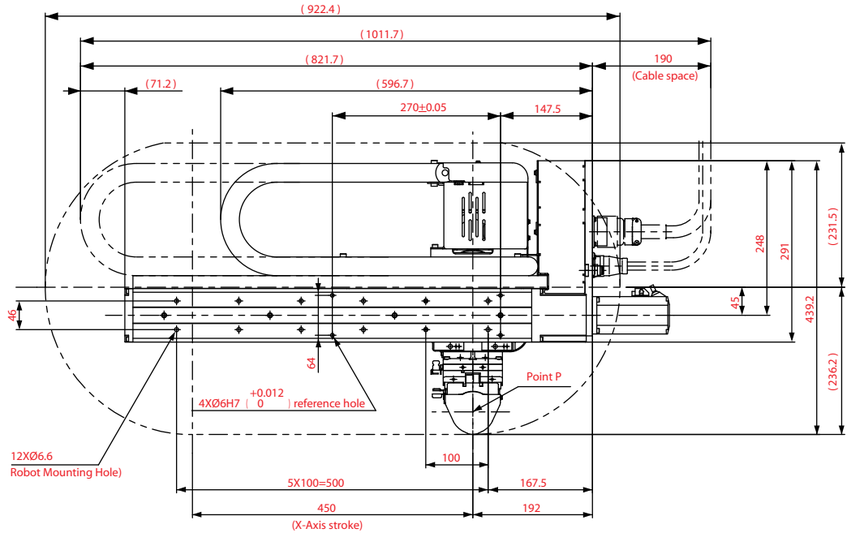
			XR-4341*G	XR-4371*G	XR-4372*G	XR-4373*G	XR-43A1*G	XR-43A2*G	XR-43A3*G
Number of axis		Unit	4	4	4	4	4	4	4
Mounting configuration			Ceiling	Ceiling	Ceiling	Ceiling	Ceiling	Ceiling	Ceiling
Arm configuration	Protection degree		-	-	-	-	-	-	-
	Cleanroom		-	-	-	-	-	-	-
UL specification			-	-	-	-	-	-	-
Maximum motion area (Point P: Wrist center)		mm	850	1160	1260	1360	1460	1560	1660
Payload		kg	5	5	5	5	5	5	5
Motion range	X-axis	mm	450	760	760	760	1060	1060	1060
	R-axis	deg	±168	±168	±168	±168	±168	±168	±168
	Z-axis	mm	*=1: 135, *=2: 200						
	T-axis	deg	±360	±360	±360	±360	±360	±360	±360
Maximum composite speed	X + R-axis	mm/s	3650	3600	3600	3600	3240	3240	3240
	Z-axis / T-axis	mm/s, deg/s	Z: 1500, T: 720						
Position repeatability (1)	X + R-axis	mm	±0.015	±0.015	±0.015	±0.015	±0.015	±0.015	±0.015
	Z-axis	mm	±0.010	±0.010	±0.010	±0.010	±0.010	±0.010	±0.010
	T-axis	deg	±0.005	±0.005	±0.005	±0.005	±0.005	±0.005	±0.005
Allowable inertia		kgm^2	0.05						
Weight (2)		kg	33	45	46	47	51	52	53
User signal line			10 (for proximity sensor signals, etc.)						
Pneumatic pipe			1 system (φ8) (with optional manifold valve: 4 systems (φ4x8))						
Brakes			Brake for Z-axis						

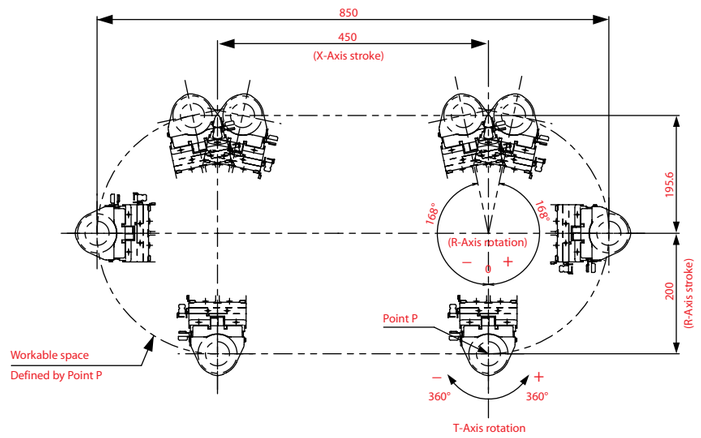
1. Position repeatability is the value at constant ambient temperature. **2.** In the case of the heaviest model (Z=200 mm).











THE DENSO CONTROLLER

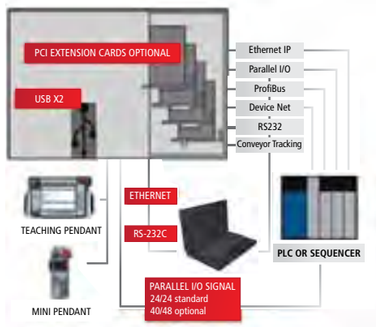
EVERYTHING YOU NEED IS JUST A TOUCH AWAY

The DENSO Controller is the smallest controller in its class and provides every conceivable feature and function. The unit is easy to use, extremely light, adaptable and highly intuitive. Key features of the DENSO Controller include:

Safety category 3

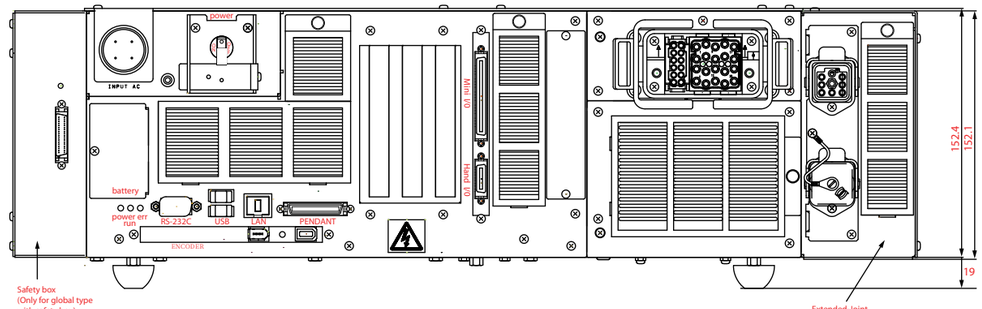
Safety category 4

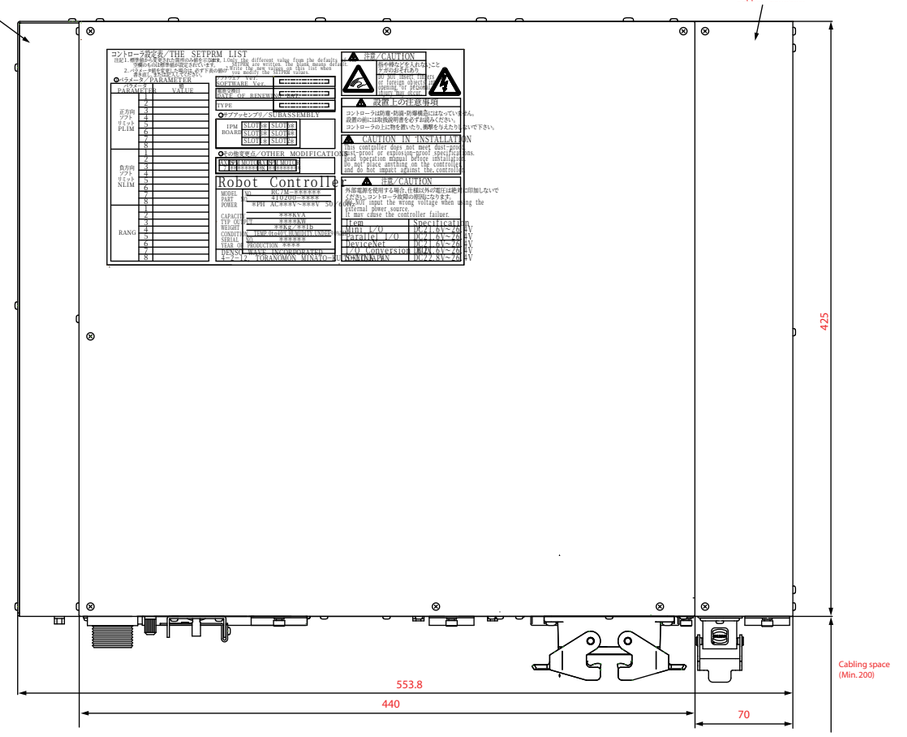
- Compact dimensions: 440 mm x 425 mm x 152 mm
- Very light weight: less than 20 kg
- Extensive variety of connection interfaces:
  - 1 x Ethernet
  - 1 x RS232C
  - 2 x USB
  - Mini I/O
  - Safety IO
  - Hand IO
- Supplementary interface options include:
  - 2 x RS232C
  - Profibus
  - DeviceNet
  - Parallel I/O extension
  - Ethernet/IP
- Large memory capacity: 3.25 MB (10 000 steps and 30 000 points)
- Memory can be expanded by an additional 2.25 MB
- Utilises DENSO's proprietary WINCAPS III software for off-line programming, simulation and management of variables, I/Os and log-files



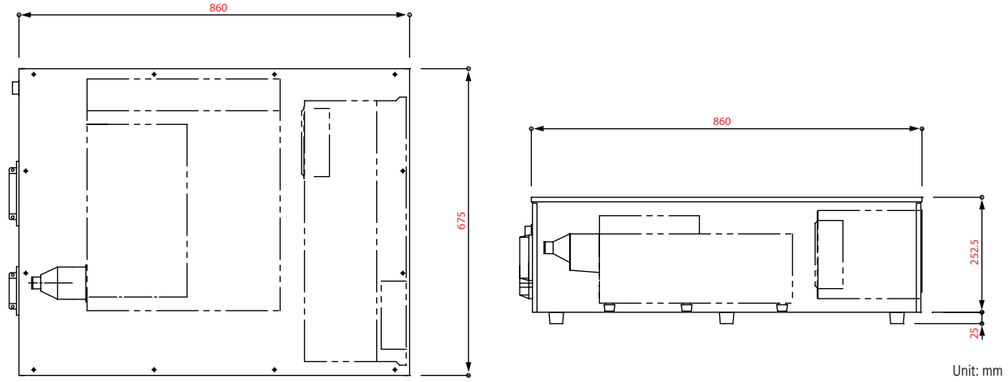
Controller model	RC7M
Size & Weight	440 x 425 x 152 mm - VP, VS, VM 18 kg / HS, HM, XR 17 kg
Control method / Drive system	PTP, CP 3D linear, 3D circular / All axes: Full-digital AC Servo
User memory capacity	3.25 MB (10 000 steps and 30 000 points) - exp. with 2.25 MB
Language used	DENSO robot language (confirming to SLIM)
No. of teaching programs	255
External signals (I/O)	Mini I/O Input: 8 user open points + 11 fixed system points Output: 8 user open points + 14 fixed system points (Note: The global type of the controller standard cannot use system-fixed emergency stop I/Os)
	Hand I/O Input: 8 user open points Output: 8 fixed system points
	Extension I/O board (option): 40 / 48 (2 boards possible)
External communication	1x Ethernet (100 Base-T)
	3x RS232C (2x option)
	2x USB (for backup storage on memory stick)
Field buses (option)	Profi bus slave board: 256/256 Ethernet IP
	DeviceNet Slave 256/256
	DeviceNet Master 1024/1024
	DeviceNet Master & Slave 1280/1280
Safety category	With safety board: compliant with safety category 3
	With safety box: compliant with safety category 4
Protection class	IP20 (protection box IP53 available)
Power source	**VP, VS, New VS, HS, HM**: Single-phase, 230 V±10 %, 50/60 Hz
	VM: 3-phase, 200 V-15 % to 230 V+10 %, 50/60 Hz

Global Type: Mini I/O Input: 8 user open points + 14 fixed system points Output: 7 user open points + 13 fixed system points





Protection box



Unit: mm

DENSO TEACHING AND MINI PENDANTS

POWER AT YOUR FINGERTIPS

The DENSO Teaching and Mini Pendants include the following user-friendly features:

- Very light
- Small and compact
- Easy to use
- Safe and secure
- 5 Languages available: Japanese, English, German, Korean, Chinese

Item		Teaching pendant	Mini-pendant
Functions	Programming	✓	✓ (1)
	Operating the robot and teaching	✓	✓
	Maintaining	✓	✓ (2)
Display		Liquid crystal display with backlight 640 × 480 pixels	Liquid crystal display 128 × 64 pixels
Power source		DC24V (supplied from robot controller)	
Outside dimensions		198 x 290 x 104 mm	242 x 102 x 75 mm
Degree of protection		IP65	
Weight		1.3 kg or less	Approx. 0.3 kg (excluding cables)
Cable length		4 m, 8 m, 12 m	

1. Mini-pendant is not able to create and edit programs. WINCAPS III Light included with mini-pendant is available to do that.
2. Mini-pendant is able to use the following maintenance functions.
   - (1) Performing CALSET
   - (2) Resetting the motor encoder data
   - (3) Setting the calendar clock built in the robot controller (Date setting)
   - (4) Setting the next battery replacement
   - (5) Releasing and locking brakes

PROGRAMMING DENSO ROBOTS

CONTROL MADE SIMPLE

Programming robots can be an extremely time consuming and challenging task, which is why we have developed a suite of tools designed to make the process as quick, simple and results-orientated as possible.

PC-based options for programming DENSO robots:

POWERED BY NATIONAL INSTRUMENTS LabVIEW™

b-CAP
binary Controller Acess Protocol

WINCAPS III

DENSO's proprietary off-line programming, monitoring and simulation software

ORiN2

Pioneering middleware that allows the use of existing high-level programming languages, including C++, C#, Visual Basic and Java, etc. to program DENSO robots. To simplify the programming process, ORiN2 provides two independent interfaces for accessing devices on a network

NI LabVIEW™ Software

The graphical programming language created by National Instruments™, NI LabVIEW™ Software has a comprehensive extension library developed by the Italian company ImagingLab created especially for communication with DENSO robots

b-CAP

Binary Controller Access Protocol is an option available within ORiN2. The system is based on Transmission Control Protocol / Internet Protocol (TCP/IP) and connects to DENSO robots and peripheral devices via a PC, PLC or any other appropriate device that includes an Ethernet connection. b-CAP is platform and programming language independent

HALCON

DENSO has created a comprehensive, dedicated extension package to enable HALCON from MVTec and DENSO users to conveniently program and control DENSO robots and their vision applications through the same simple graphical interface

NI LabVIEW™ Software is trademark of National Instruments™ HALCON and MVTec are registered trademarks

WINCAPS III

Off-line programming, monitoring and simulation software

Based on DENSO's PAC programming language, WINCAPS III enables users to conveniently program, design, implement and perform maintenance on their robotic applications. The software has been created to provide a simple and intuitive system that includes extensive simulation features. These functions reduce the effort required to plan, apply and maintain core robotic exercises, saving time and expenditure.

Item	Full Function Version	Light Version	Trial Version
Create new program / edit program	✓	✓	✓ (1)
Program bank	✓	✓ (2)	✓ (2)
3D CAD data import	✓	-	-
3D view teach NEW	✓	✓	✓
Simulation function NEW	✓	-	-
Debugging	✓	-	-
Monitoring	✓	✓ (3)	✓ (3)
Movie save function NEW	✓	✓	✓
Print	✓	-	-
Simple calibration NEW	✓	✓	✓

Entering a user ID upgrades the trial version to the Full Function version. **1.** 1program (PRO1) only. **2.** Number of library limited. **3.** Sampling interval: 1 sec.

Key advantages:

- Off-line programming allows robots to be programmed through a PC without the need for a physical connection to either the robot or the controller
  - Input information and change variables with ease and clarity
  - Import CAD drawings in standard VRML and DirectX formats
  - Click an object with a mouse and a robot end moves to the position immediately. Obtain the position data (teaching) easily NEW
- 3D simulation of robots and peripherals allows you to achieve the following with the minimum of effort:
  - Plan the layout of automated workcells in a virtual environment
  - Verify robot arm reach
  - Determine obstacle clearances and detect potential collisions
  - Troubleshoot and debug programs
  - Confirm process cycle times
  - Save a simulation movie NEW
- Remote monitoring
  - Examine workcell operation using 3D simulation, real time I/O status indicators and detailed control logs
- Panel designer
  - Customise the Teaching Pendant display to your preferences
- Simple calibration
  - Calibrate easily with simple calibration wizard NEW

ORiN2

Middleware for programming DENSO robots, peripheral devices and all your factory automated processes

This pioneering software includes two separate and distinctive interfaces for accessing and controlling devices on a network. One interface is used for the development of 'Applications and Case Studies'; and the other is used for actually connecting to specific devices.

The Application Programming Interface (API) provides a common object model for all of your network devices, each of which can then be plugged into ORiN2 by creating a dedicated 'provider'.

This separation of processes simplifies and streamlines the implementation of your programming procedures.

ORiN2 also provides extensive protocols for internet connection.

- ORiN2 provides the unified access from a PC to a lot of devices such as an industrial robot and a PLC
- ORiN2 enables to easily use the distributed object technologies such as DCOM and SOAP, and it provides two standardized software interfaces, Application Interface and Device Interface
- ORiN2 SDK enables to use a lot of development tools such as Visual Basic, Visual C++ and Delphi supporting OLE (COM, ActiveX)
- ORiN2 SDK provides a lot of utility tools which make it easy to create an application and a provider. Ex. Provider Wizard, CAO Tester

Package Type	ORiN2 SDK Full-set			ORiN2 SDK Runtime			ORiN2 SDK Bundle		
Item	Support	Binary	Source	Support	Binary	Source	Support	Binary	Source
CAO Engine	✓	✓		✓	✓		✓	✓	
Provider Development Tools	✓	✓							
CAO Provider (number)	✓	✓	✓	✓	✓		✓	✓	
(Ready-made Providers)	12	61	44	12	61	0	7	7	0
Test and Configuration Tools	✓	✓		✓	✓		✓	✓	
CAO-OPC	✓	✓		✓	✓				
CAO-SQL	✓	✓		✓	✓				
CAO-UpnP		✓			✓				

Bundle version:

This edition includes providers for the DENSO Controller and allows you to write program code in standard languages

Runtime version:

This edition of ORiN2 is similar to the Bundle version but includes additional interfaces for device options

SDK version:

The same as the Runtime version but with the functionality to create custom interfaces

System Requirements: OS: Windows® 2000/XP Professional/Vista PC: CPU Pentium III 1 GHz, Memory 512 MB, HDD 500 MB

Windows is a trademark or registered trademark of Microsoft Corporation in the U.S. and/or other countries

ADDITIONAL SUPPORT SOFTWARE

b-CAP is based on Transmission Control Protocol / Internet Protocol (TCP/IP)

This control protocol enables connection to DENSO robots and peripheral devices using a PC, PLC or other device which incorporates Ethernet TCP/IP or UDP.

It works completely independently of any incumbent platform or programming language.

Key advantages:

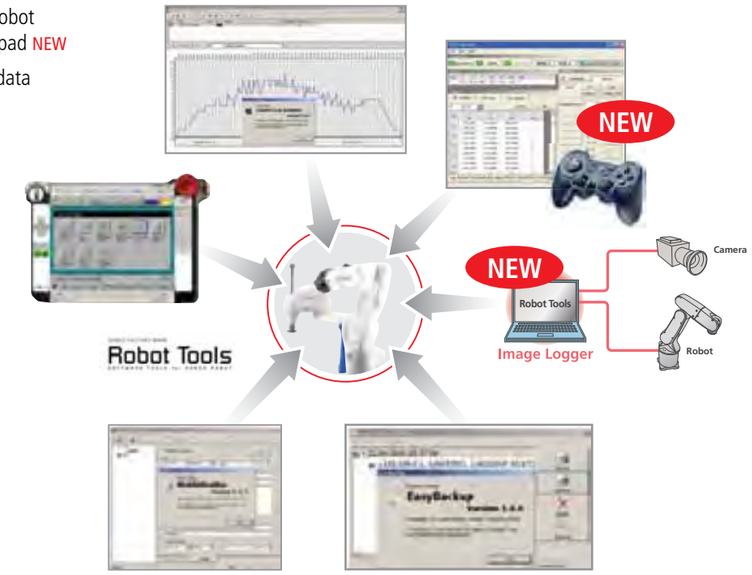
- Highly flexible and powerful control through PCs, PLCs or other applicable hardware device using TCP/IP or UDP
- Platform and programming language independent
- No requirement to learn a new robotic programming language

Robot Tools (based on ORiN2)

Robot Tools is a fully featured suite of utility tools created to enable the optimum maintenance and operation of DENSO robots. The software streamlines daily maintenance workflow and reduces the running costs of a robot after installation.

Key advantages:

- GP operator: Operate / teach a robot via PC with a mouse or a game pad NEW
- Image logger: save images and data before and after an error NEW
- Virtual TP: a PC-based virtual teaching pendant
- Mobile monitor: sends error notices via email
- Control log analyser: provides management of historical data and visualisation of servo statistics
- Easy backup: back up all data from controllers on the network with one click operation



Product name	Function
GP operator NEW	Connect a robot controller with a PC and operate / teach a robot with a mouse or a game pad Monitor current robot position / variables (Type P, J and T) or images from an isolated environment (e.g. cleanroom) Assist an engineer to control a robot via PC.
Image Logger NEW	Help to determine causes of sudden error and wrong assembly in your production. Capture images around the error and save equipment data (I/O, variable etc.). Specify the error cause through validation of the images and the data and contribute equipment improvement.
Virtual TP	Works with a controller set on a manual mode: various settings can be made on the GUI based Virtual TP. Robot teaching can also be done with a Mini Pendant.
Control Log Analyzer	Obtains Control Log from a designated controller and analyzes the robot operating status by graphing out the Control Log: visualizes the operating status.
Easy Backup	Backups and restores all data of multiple controllers with a single click. Consolidates the compressed data: enriches the portability and maintenance performance of robot facilities.
Mobile Monitor	Monitors controllers operating status and notifies errors or troubles through portable devices to an operator even not at the site.

System Requirements: OS : Windows® 2000 SP4 or later, Windows® XP SP1 or later, Windows® Vista PC : CPU Pentium® III 1 GHz or faster / Memory 512 MB or more / HDD 500 MB or more. ORiN2 is a registered trademark of Japan Robot Association

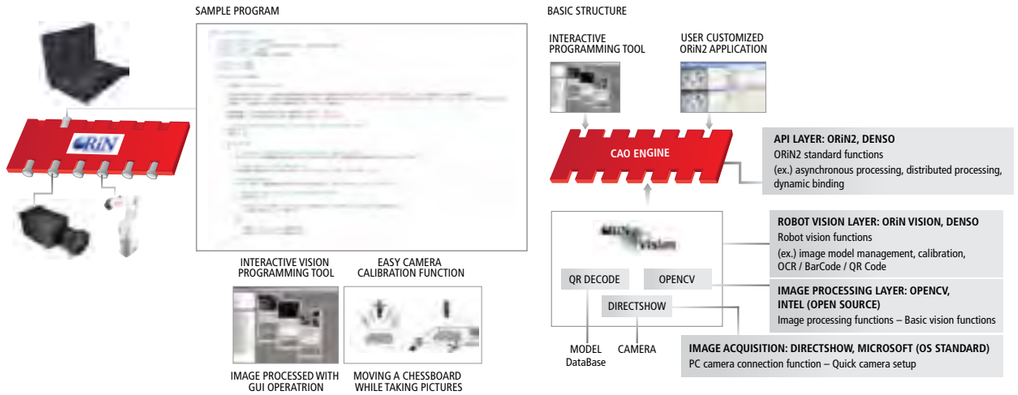
ORiN Vision

ORiN Vision is the extensive vision library designed exclusively for ORiN2 middleware.

The library allows you to directly program robot vision applications with standard high-level languages including C++, C# and VB among others.

Key advantages:

- Built-in processing functions use the OpenCV standard
- High-level image processing fuctionality
- The system is hardware independent allowing you to connect to any off-the-shelf camera regardless of interface (analogue, USB, IEE 2394, etc.)
- Fast and efficient procedures result in short development times


SAMPLE PROGRAM
BASIC STRUCTURE
INTERACTIVE PROGRAMMING TOOL
USER CUSTOMIZED ORiN2 APPLICATION
CAO ENGINE
API LAYER: ORiN2, DENSO
ORiN2 standard functions
(ex.) asynchronous processing, distributed processing, dynamic binding
ROBOT VISION LAYER: ORiN VISION, DENSO
Robot vision functions
(ex.) image model management, calibration, OCR / BarCode / QR Code
QR DECODE
OPENCV
DIRECTSHOW
IMAGE PROCESSING LAYER: OPENCV, INTEL (OPEN SOURCE)
Image processing functions – Basic vision functions
MODEL DataBase
CAMERA
IMAGE ACQUISITION: DIRECTSHOW, MICROSOFT (OS STANDARD)
PC camera connection function – Quick camera setup
INTERACTIVE VISION PROGRAMMING TOOL
EASY CAMERA CALIBRATION FUNCTION
IMAGE PROCESSED WITH GUI OPERATRION
MOVING A CHESSBOARD WHILE TAKING PICTURES

VISION-GUIDED ROBOTIC
SOFTWARE SOLUTIONS

e.vision

e.vision is a software system for programming DENSO robots using computer vision, which is based on ORiN Vision (an extension of the ORiN2 software package).

Using a clear and simple Graphical User Interface, e.vision allows you to directly manipulate and configure the actions of the robot through basic trial and error.

This incredibly user-friendly and easy to use system is intended for engineers and system integrators with limited knowledge of computer vision.

Key advantages:

- Extremely user-friendly structure and interface
- The easy vision configuration tool for "pick and place" applications is exceptionally fast, simple and effective
- It works extensively with Anyfeeders from Flexfactory
- It is also possible to directly configure Flexfactory's Anyfeeders
- It includes two helpful Wizards that provide step-by-step guidance through core features including camera calibration and your vision applications

VISION-GUIDED ROBOTIC SOFTWARE SOLUTIONS

HALCON from MVTec with extension package for DENSO robots based on ORiN2

HALCON software provides an integrated development environment (IDE) for machine vision and has become one of the worldwide industry standards.

Because HALCON is so widely used and highly regarded, DENSO has created a comprehensive, dedicated extension package to enable HALCON and DENSO users to conveniently program DENSO robots and control their vision applications through the same simple graphical interface.

This integrated development environment, which is called HDevelop, is intended for engineers with a thorough knowledge of machine vision, but with a limited understanding of robotics.

Key advantages:

- DENSO robots can be programmed directly using one clear and practical interface
- The DENSO extension package is conveniently and seamlessly incorporated into the HALCON integrated development environment, HDevelop
- No previous experience of robotic programming is required
- The HALCON extension package offers a complete and powerful solution with more than 1400 commands for operations including blob analysis, morphology, pattern matching, measuring, identification and 3D vision

ROBOTIC CALIBRATION TOOLS

ROSY (Robot Optimization System) calibration kit for DENSO robots

Certain robotic tasks and applications require a level of precision and accuracy of pose that can only be achieved through more advanced methods of calibration.

The ROSY (Robot Optimization System) calibration kit enables you to achieve these advanced levels of precision in a sophisticated, direct and straight forward manner.

ROSY utilises a calibration sphere and cameras to assess kinetic errors. The resulting correction values are calculated and the control parameters can then be adjusted accordingly with a minimum of effort.

Key advantages:

- The user can increase the already exceptional accuracy of DENSO robots even further for special applications
- The whole process can be accomplished easily and is usually completed in less than an hour
- Identical and accurate robot cells can be created quickly and efficiently
- On-site calibration service

SIMULATION TOOLS

3DCreate

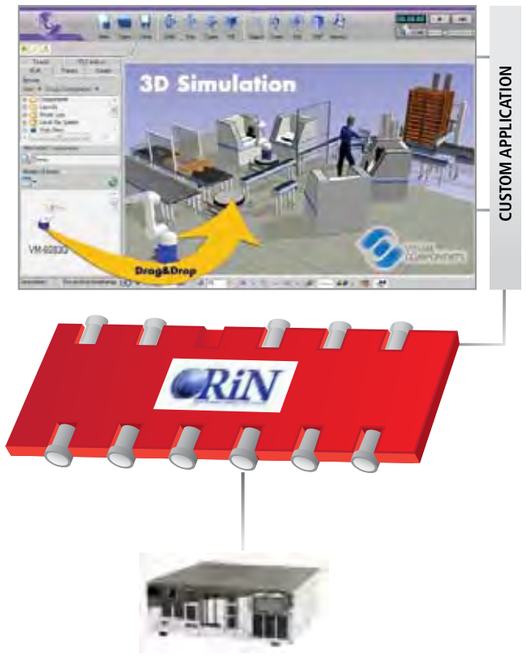
Implementing a professional robotic solution is a substantial and serious project which can have a major impact on the whole of your business. Whether you are investing in a single arm, or a complete automated production facility, it is vital that you are confident in the potential performance of your installation.

Visual Components® – the world's leading provider of 3D robotic and manufacturing software created 3DCreate® which is a simple, quick and cost-effective software tool that enables machine builders, system integrators and manufacturers to simulate complete factory layouts in a virtual environment.

This highly innovative and powerful solution provides all of the functions you need to create new simulated components from existing 3D CAD data, allowing you to customise, observe and evaluate your industrial robotic applications in advance.

Key advantages:

- Use ready-made robot models from online eCatalogue
- Easy plug'n'play interface for layout design
- Integrate robot cells with factory layouts
- Parametric components suit various customer cases
- Connect to an external controller



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